GUIDE SPECIFICATION

The following are very specific guide specifications for fire protection systems. The proposed system shall be discussed with the Project Manager. An asterisk (*) beside an item in the following indicates an item which is variable for each project. Where [ ] or { } appear indicates requirements which are optional depending upon the type of system being provided or per instructions associated with the [ ] or { }. The handling of such items will be decided by the Project Manager. The Project Manager is expected to modify other portions as necessary to accurately reflect conditions of the project.

FIRE PROTECTION SYSTEM - SECTION 15300

PART 1 GENERAL INFORMATION AND REQUIREMENTS

1.01 SCOPE OF WORK:

A. Work Included: Provide all material, labor, equipment, design and services necessary to perform the installation of the fire sprinkler system described in the specification and as shown on the drawings.

B. Summary of Work: *DESIGNER, REFER TO SECTION 15300, FIRE PROTECTION FOR DESIGN CRITERIA.*

Designer, describe basic details of the system. Include: wet or dry system, calculated or pipe schedule, density/area if calculated, hazard classification, revision to existing system or new system, complete new system or individual areas to be covered, not covered, etc.

C. Existing Sprinkler Equipment: Existing sprinkler equipment shall be [maintained fully operational until the new equipment has been tested and accepted by the City and Seattle Fire Department] [left in service] [re-piped] [removed] as indicated in the contract drawings.

D. Equipment Removal: After acceptance of the new system by the City and Seattle Fire Department, all existing equipment so indicated shall be removed and all damaged surfaces shall be restored as herein specified.

1.02 QUALITY ASSURANCE:

A. Codes and Standards: This installation shall conform to the latest edition at the time of bid of each of the following:

1. NFPA 13, all appendices, Installation of Sprinkler Systems,
2. NFPA, Automatic Sprinkler System Handbook,
3. NFPA 14, all appendices, Standpipe and Hose Systems,
4. NFPA 24, all appendices, Private Fire Service Mains,
5. Uniform Building code, include Seattle Amendments,
6. Uniform Fire Code, including Seattle Amendments,
7. Uniform Mechanical Code, including Seattle Amendments,
8. Underwriters Laboratories Fire Protection Equipment Directory,
9. Factory Mutual Approval Guide.
10. DCLU Elevator Rule #3-91.

B. Qualifications of Contractor:

1. All work shall be performed by a Contractor with a valid Washington state Contractor's license for the installation of fire sprinkler systems.

2. The system shall be designed by a NICET Level 3 certified sprinkler designer. The field installation shall be supervised at all times by a journeyman sprinkler fitter.

1.03 APPROVALS:

A. Authority Having Jurisdiction: For purposes of code compliance the Authority Having Jurisdiction (AHJ) for this installation will be the Seattle Fire Department. Where there are conflicts between the AHJ and the referenced codes and standards, the more stringent shall apply. If there is a question of interpretation as to which is more stringent, it shall be decided by the Owner.

1.04 SUBMITTALS:

A. Material Submittals:

1. Within 28 days of the Notice to Proceed furnish to the A/E a complete list of equipment and products, and a manufacturer's catalog sheet for each item to be included in the project. Six (6) copies are required, each bound separately in a soft cover three-hole binder. All material submittals shall include all items listed in the product section and all additional items necessary to provide a complete installation.

2. Partial submittals are not acceptable and will be rejected without review. Where more than one item appears on a manufacture's catalog sheet, the item or items to be used shall be indicated.

B. Welding Submittal: Unless approved otherwise, all welding shall be done in-shop, not in the field.

1. Within 28 days of the Notice to Proceed submit welding procedures that comply with NFPA 13 section 3-12 and Specification for Qualification of Welding Procedures and Welders for Piping and Tubing, American Welding Society, Inc. (AWS) D10.9 Standard for Building Service Piping, level AR-3. Submit the following forms:

a. Typical Welding Procedure Specification (WPS)

b. Typical Contractor's Procedure Qualification Test Record (PQR)

c. Typical Contractor's Welder Qualification Tests Record

C. Shop Drawings: *Designer, reduce submittal time for smaller jobs.*

1. Within 45 days after the award of the contract and prior to any installation or fabrication of the system components, Contractor shall submit six (6) sets of shop drawings plus a reproducible sepia and the same number of hydraulic calculations to the A/E for approval by the A/E and the Owner.

2. Incomplete shop drawings will be rejected unless prior approval is requested and given from the A/E and Owner for partial submittals. Shop drawing shall conform to, and include all items as set forth in NFPA 13.

3. After approval is received from the A/E and Owner, submit shop drawings to DCLU for Seattle Fire Department approval. Deliver copies of the shop drawings bearing the approval stamps to the Owner.

1.05 DRAWINGS OF RECORD:

A. Updating Drawings: Provide and keep up-to-date, a complete record set of approved shop drawings, corrected daily to show every change from the approved shop drawings. Keep this set of prints on the job site and use only as a record set. The up-to-date drawings shall be reviewed each month by the A/E prior to the application for payment.

B. Final Record Set: Upon completion of the work, the record drawings and hydraulic calculation shall be submitted for approval by the A/E and Owner. After receiving approval, the record set shall be used to produce a set of ink on mylar drawings of the complete installation. The record set of original mylars or photographed blueline mylars with the negatives and hydraulic calculations, shall be turned over to the Owner. Reproducible sepias are not acceptable.

1.06 OPERATIONS AND MAINTENANCE MANUALS

General: Not less than 7 calendar days prior to the final acceptance testing of the entire system, and for use during the instruction period hereinafter specified, provide six bound copies of an Operation and Maintenance Manual to the Project Manager. the manual shall include an index, copies of all approved shop drawings and submittal materials (updated to as-built), and a complete parts list of all components. The manual shall also include, for each item, the manufacturer's name, the serial number of the part, an ordering number, if appropriate, and a physical description of the part. The manual shall include all data relative to [alarm valves], [excess pressure pumps], and [waterflow and tamper switches].

PART 2 PRODUCTS AND MATERIALS:

2.01 GENERAL:

A. Materials and Equipment: All materials and equipment in the system shall be new and current products of a manufacturer regularly engaged in the production of such materials and equipment. Where two or more pieces of equipment are required to perform interrelated functions, they shall be products of one manufacturer.

B. Approval Guides: Unless otherwise indicated, all products shall be listed in the latest publication of Approval Guides for Underwriters Laboratory and Factory Mutual for the service intended.

C. Acceptable Manufacturers: Manufacturer of sprinkler specialties shall be; Central, Grinnell, Reliable or Viking.

2.02 PIPE

A. Provide piping, valves, and fittings, approved for [175] [300] psi working pressure, in accordance with NFPA 13, as indicated on the drawings and as specified herein.

Conceal [all piping] [piping in areas with suspended ceilings] piping as indicated on the contract drawings.] [Leave piping exposed as indicated on the contract drawings.] Provide fittings for changes in direction of piping and for connections. Make changes in piping through tapered reducing pipe fittings; bushings will not be permitted. [Steel piping with wall thickness less than Schedule 30 shall not be threaded.] Side outlet tees using rubber gasketed fittings shall not be permitted.

B. Galvanized Pipe: *Designer, discuss with Project Manager the use of galvanized pipe.*

C. Underground Pipe: All piping upstream of the double backflow preventer shall be ductile iron class 52 and cement-mortar lined whether inside or outside of the building.

D. Rust Inhibitive Paint: All exposed threads on galvanized pipe are to be coated with rust inhibitive paint.

E. Color Coding: *Designer, color coding is to be included, if section 15190 is not included in the specifications then include the applicable requirements in this section.*

Refer to section 15190 for requirements.

2.03 FITTINGS AND COUPLINGS:

A. Rust Inhibitive Paint: Grooved Fittings and couplings shall be coated with a rust inhibiting paint.

B. Threaded Fittings: Threaded fittings shall be cast iron class 125, rated for 175 psi. cold water working pressure and shall conform to ANSI B16.4, ASTM 126 and ANSI B2.1 NPT. Malleable threaded fittings will not be permitted.

C. Nipples: No close nipples will be permitted. For short pipe connections use standard short nipples.

D. Adjustable Nipples: Adjustable drop nipples may be used on flush or concealed type sprinklers only and must be of double o-ring seal design.

E. Thread-O-Lets: Shop welded Thread-O-Lets may be used where a certified welder is used, meeting the requirements of paragraph 1.04.B. and the Thread-O-Lets are listed.

F. Grooved Fittings: 90's, 45's, Tees, and reducers shall be malleable iron or ductile. The fittings shall be by Gustin-Bacon, Gruvlok, Victaulic, or approved equal.

H. Adapter Flanges: Adapter flanges (fittings) shall be cast iron/class 125 conforming to ANSI B-16.1, with a rust inhibiting coating. The adapter flanges shall be by Gustin-Bacon, Gruvlok, Victaulic, or approved equal.

I. Grooved Couplings: Grooved couplings and reducers shall be malleable or ductile iron conforming to ASTM A-47. Coupling gasket shall be molded Elastomer (EPDM) per ASTM D2000, Victaulic grade "E" (type A) or equal. On dry pipe systems a "FlushSeal" or "Flush Gap" gasket shall be used. Grooved couplings and reducers shall be of the same manufacturer as used for the grooved fittings.

J. Plain End Couplings: No plain end couplings (Roust-A-Bouts, Plainloks or similar couplings) may be used on either new or existing sprinkler systems.

K. Hole Cut Outlets, New Systems: No hole cut outlets may be used on new sprinkler systems.

L. Hole Cut Outlets, Existing Systems: Hole cut bolted branch outlets couplings may be used on existing sprinkler systems only in isolated locations as approved by the Owner. Hole cut outlets shall be a full bodied outlet (U-bolt outlets will not be permitted) style 920 by Victaulic or approved equal by Gruvlok or Gustin-Bacon.

2.04 HANGERS AND SUPPORTS:

A. Hangers: Provide hangers to support all piping: in perfect alignment without sagging or interference, to permit free expansion and contraction, and meet the requirements of NFPA 13.

B. Pipe Rings: Pipe rings to be zinc coated Grinnell figure 69 or approved equal.

C. Hanger Rods: Hanger rods to be electro-galvanized.

D. C-Clamps: All c-clamps (beam clamps) shall be equipped with earthquake retaining straps.

E. Riser Clamps: Riser clamps shall not protrude more than 2" beyond the edge of the hole. The riser clamps need be only UL listed, Grinnell figure 261 or approved equal

F. Concrete Anchors: Concrete expansion anchors shall be Hilti, Phillips, Impex, ITW, or approved equal.

G. Explosive Anchors: Explosive type fasteners are not permitted.

2.05 EARTHQUAKE BRACING: Earthquake bracing shall be with a pipe clamp and pipe with a swivel type anchor or similar to those illustrated in NFPA 13.

2.06 VALVES:

A. Outside Screw and Yoke (OS&Y) Valves: OS&Y valves shall be cast iron, flanged and rated for 175 psi, non-shock cold water working pressure.

B. Supervised Valves 2 Inches and Smaller: Sprinkler controlling valves 2 inches and smaller shall be Slow-Close Supervised Butterfly valve from Milwaukee Valve Company, model BB-SC. No exceptions.

C. Valves Controlling Sprinklers in Elevator Machine Room and Top of Elevator Shaft: Sprinklers located in elevator machine rooms and at the top of the elevator shaft shall be controlled by a normally closed supervised Butterfly control valve from Milwaukee Valve Co., model BB-S02-R. *Designer consult with Project Manager if it is a High-Rise building or High-Rise building requirements are being applied to this project.*

D. Drain Valves: Drain valves need only be UL Listed, screw-in bonnet bronze globe valves, rated to 175 psi non-shock cold water working pressure by Nibco, United or

approved equal. Low point drain valves shall have, in addition, a 3/4" brass nipple with 3/4" male hose threads and cap.

E. Check Valves: Check valves shall be: grooved, iron body, bronze seat, stainless steel clapper with a replaceable rubber seal (a rubber seal integral with the seat is not acceptable), and 175 psi non-shock cold water working pressure. Viking model D, Central model 90 or approved equal.

F. Double Detector Check Valve Assembly: *Designer, modify Standard Drawing SD-M-17 as necessary and include in the Contract Documents.* Assembly shall be Ames 3000 DCDA, Febco 856, 876 or 876V, or Watts 709 DCDA or 770 DCDA.

Provide a weighted clapper double check valve assembly including the two OS&Y gate valves. The assembly shall be an approved double check valve assembly on the latest listing from the Washington State Department of Social and Health Services for cross connection devices. Double check valve assembly shall be by Viking, Febco or Watts.

2.07 SPRINKLERS:

A. Sprinklers: Provide ordinary temperature rated sprinklers with a 1/2" orifice. Areas subject to high temperatures exceeding 110 degrees Fahrenheit or as noted in NFPA 13 shall have sprinklers rated for 212 degrees Fahrenheit or as required.

* Designer, describe each sprinkler to be used for all areas of the project, including style (upright, pendent, sidewall, semi-recessed etc.); type (fusible link, solder, or frangible bulb); finish (white, brass, chrome, decorator color, etc.); and type and finish of any canopies or escutcheons when applicable. Try to list at least three different manufactures and model numbers for each type of sprinkler.*

* Designer, example for sprinkler description:

Semi-Recessed Sprinklers: Provide semi-recessed sprinklers are in all finished lay-in or plaster ceilings. Provide chrome sprinklers with a white escutcheon. Provide Reliable model F1 Recessed, Viking Micromatic Model M with escutcheon model E-1, Gem model F985, or approved equal.*

B. Spare Sprinklers: Provide spare sprinklers and escutcheons shall for each type and style of sprinkler used in accordance with NFPA 13 and proportioned based upon the number of each type and style of sprinkler used on the job. Spares of dry-pendent sprinklers are not required.

2.08 SPARE SPRINKLER CABINET: Provide a spare sprinkler cabinet to accommodate the required number of spare sprinklers and escutcheons. Include a wrench for each type of sprinkler in the cabinet. Paint the cabinet fire red and keyed to a BEST Lock AA16. Label the cabinet with a riveted or screwed laminated plastic nameplate indicating "SPARE SPRINKLER CABINET" in white letters on a red background, letters to be 1/4" high.

2.09 SPRINKLER HEADGUARD: Provide UL Listed sprinkler headguards for sprinkler heads subject to mechanical damage or for any sprinkler lower than 7'-0" above the floor.

2.10 FIRE DEPARTMENT CONNECTION: *Designer, a sign indicating "Auto Sprinkler" or similar shall be provided as a part of the escutcheon or as a separate sign permanently affixed to the

building. Lettering for the sign shall be a minimum one inch high. Choose either chrome or polished brass for the FDC and escutcheon.*

Provide a fire department connection (FDC) with horizontal type connections, dual clapper, 2-1/2" inlets, with rocker lug caps, and chains.

2.11 BALL DRIP: Provide a bronze ball drip for the fire department connection inside of the building and pipe to the nearest floor drain.

2.12 ROOF FIRE DEPARTMENT CONNECTION: *Designer, consult with Seattle Fire Department on the requirements for a roof FDC.*

Provide a wall type indicator post and gate valve for the roof indicator post, with a two-way roof fire department connection with rocker lug caps and chains, Potter-Roemer 5870 series or approved equal.

2.13 POST INDICATOR VALVE: Provide a post indicator valve (PIV) on the fire service water main into the building.

2.14 HOSE VALVE: Provide 2-1/2" polished brass hose valves with a cap and chain. Turn the outlet at an angle of 45 degrees from the wall. The cap is to have a 1/8" diameter hole drilled in the face to relieve any water pressure. Potter-Roemer model 4065 with model 4626 (cap and chain) or approved equal.

2.15 SIGHT DRAIN: Provide a single piece sight drain by Grinnell or approved equal.

2.16 PRESSURE GAUGE: Provide a 3-1/2" diameter, bourdon type pressure gauge, 0-300 lbs, 1/4" soft metal seat globe valve with arrangements for draining pipe between gage and valve, located near each main or floor control valve assembly on the main line or near each test location.

2.17 DRUM DRIP: Provide a cast iron drum drip at the low drain points on a dry system.

2.18 SPLASH BLOCK: Provide a splash block at the point of discharge for the drains outside of the building, if the ground will be disturbed by the flow of water.

2.19 SLEEVES: Provide 24 gauge galvanized sheet metal with lock seam joints or 1/2 inch overlap sleeves in floors, partitions, ceilings, and in construction without waterproof membranes. Provide schedule 40 galvanized steel pipe sleeves in exterior walls. Provide schedule 40 pipe sleeves with clamping rings in slab-on-grade or exterior walls having below grade penetrations. Provide sleeves through roofs with flashing collars.

2.20 LINK SEALS: Provide link seals when underground pipe passes through an exterior wall or slab. Flexible couplings, located within one foot of each side of the wall must be included with the link seal installation. This is a requirement of NFPA 13 and the Seattle Fire Department.

2.21 WALL ESCUTCHEON: Provide plastic split ring type escutcheons and paint to match the wall. Escutcheons are only required with exposed pipe installations.

2.22 DRY PIPE ALARM VALVE: *Designer, for dry systems only.*

Provide a dry pipe alarm valve, trim package, accelerator and air maintenance device. All by the same manufacturer.

2.23 AIR COMPRESSOR

A. *Designer, for dry systems only*

B. Provide an air compressor, sized to completely refill the system within 30 minutes*

2.24 FIRE ALARM AND RELATED EQUIPMENT: Equipment in this section shall be provided, installed, and adjusted by the sprinkler Contractor. Conduit, wiring, and terminations, shall be by others.

A. Waterflow Switches

1. Vane-Type switches: Provide vane-type waterflow switches where indicated on the drawings. The device shall contain double pole, double throw contacts and screw terminals for each conductor. Devices shall also be equipped with a time delay feature which is field adjustable from zero to at least 90 seconds. The time delay shall be initially set to 30 seconds.

2. Pressure Switch: Provide pressure-type waterflow detectors where indicated on the drawings. The device shall contain double pole, double throw contacts and screw terminals for each conductor. The device must have a time delay feature which is field adjustable from zero to at least 90 seconds. The time delay shall be initially set to 30 seconds.

B. Supervisory (Tamper) Switch

1. General: Provide a tamper switch for each interior sprinkler system control valve, as well as outside post indicating valves. Tamper switches shall have two sets of single pole, double throw contacts with screw terminals for each conductor. Operation of the switch shall cause a supervisory signal to be transmitted to the FACP upon not more than two complete turns of the valve wheel or a closure of 20, whichever is less.

C. Stop and Waste Valve: *Designer, for dry systems only*

Potter Bleeder Valve BVL-1000018. No exceptions

D. Supervised Valves 2 Inches and Smaller: Slow-Close Supervised Butterfly valve from Milwaukee Valve Company, model BB-SC. No exceptions.

E. Valves Controlling Sprinklers in Elevator Machine Room and Top of Elevator Shaft: Sprinklers located in elevator machine rooms and at the top of the elevator shaft shall be controlled by a normally closed supervised Butterfly control valve from Milwaukee Valve Co., model BB-S02-R. No exceptions. Note: These valves activate the elevator shunt trip only and are not associated with the fire alarm system.

2.25 SIGNS: Provide all control, drain and test valves with signs identifying the type of valve and the area (floor or portion of the building) affected by the valve. Signs shall be three layer etched plastic with red letters on a white background. Letters are to be minimum 1/4" high. Submit the wording for approval, for example "CONTROL VALVE FOURTH FLOOR NORTH". The signs are to be hung by a chain from the valve. If the system is a calculated system provide a sign in accordance with NFPA 13.

2.26 FIRESTOPPING MATERIAL: Firestopping material is to be UL classified Bio Fireshield BFS100, 200 caulk or approved equal.

2.27 PIPE THREAD SEALANT: Provide a brush-on pipe thread sealant with Teflon, Grinnell Tuff-Loc or approved equal. Teflon tape will not be permitted.

PART 3 EXECUTION:

3.01 GENERAL:

A. Requirements Prior to Installation: Do not order, fabricate, or install any material prior to receipt of all approvals as stipulated in Part 1 of this Section.

B. Standards and Requirements: All installation work shall be performed in accordance with the reference standards without exception, and as required by the AHJ. All piping shall be installed straight, true and plumb.

C. Changes to the Work: Install all piping as shown on the approved shop drawings. Minor deviations shall be carefully noted on the record drawings as outlined in Part 1 of this Section. Before making significant deviations from the approved drawings, written approval must be obtained from the Owner and the AHJ.

D. Coordination of Work: Carefully coordinate work with other trades so that unnecessary offsets and revisions to the approved drawings are avoided. Failure to coordinate does not relieve Contractor from meeting the performance standards herein.

3.02 SHUTDOWN OF EXISTING SYSTEMS: Any shutdowns of existing water distribution systems, fire sprinkler systems, domestic water systems or fire alarm systems shall be approved by the Project Manager. Advance written notice of at least 14 days prior to the shutdown must be provided to the Project Manager.

3.03 PENETRATIONS:

A. Required Clearance Around Pipe: Piping passing through fire rated assemblies, including fire rated GWB assemblies shall be provided with clearance around the entire circumference of the pipe as required by NFPA 13, paragraph 3-5.3.4 Piping 3-1/2" and smaller shall have a minimum one inch clearance around the entire circumference of the pipe and pipe larger than 3-1/2 shall have a minimum two inch clearance around the entire circumference of the pipe. No exceptions. Penetrations of walls, floors or ceilings shall be made in a neat manner using properly sized hole saw or masonry/concrete coring as necessary.

B. Fire Rated Assemblies: The annular space between the wall or pipe sleeve and the sprinkler pipe in fire rated assemblies shall be filled with UL classified firestopping material in accordance with the manufacturer's recommendation, also see paragraphs 2.19 and 2.26. Apply firestopping material over a noncombustible backing material (fire safing), oakum is unacceptable.

C. Escutcheons: Split wall plates or escutcheons shall be installed where exposed piping or hangers pass through a finished floor, wall or ceiling and shall fit snugly, securely and cover the opening.

3.04 CONTROL VALVES: Install all control valves, supply valves and test valves in easily accessible locations, with the valve handle or wheel no higher than seven feet above the finished floor. *Designer, modify Standard Drawing SD-M-18 (Floor Control Valve Assembly) and include on the Contract Drawings.*

3.05 INSPECTOR'S TEST AND DRAINS:

A. Inspector's Test: *Designer, modify this paragraph as necessary.*

Provide inspectors test valves for each floor of each system. For buildings two stories or less the inspector's test assembly shall be piped to discharge outside the building and shall be located at the hydraulically most remote part of the system. For buildings higher than two stories, the inspector's test assembly shall be piped from the end of a branchline located near the system riser. Discharge shall be into a drain riser located adjacent to the system riser or to a drain for a remote inspectors test valve when provided i.e. dry systems. The valve shall be readily accessible, at a location no higher than seven feet above finished floor.

B. Main Drains: *Designer, coordinate with the plumbing drawings to indicate the appropriately sized floor funnel drain when required.*

Provide main drains at all system and floor control valves. Discharge shall be into drain risers for a multi-story building. Drain risers and main drain for single story buildings shall discharge to a safe location outside the building wherever possible. Splash blocks shall be provided to limit damage to landscaping. Where outside discharge cannot be achieved, discharge shall be to minimum 6" floor drain, with a funnel. No sprinkler system drain line is to be piped directly into a drain; there must be at least a 1/2" gap between the pipe and the funnel/drain.

C. Auxiliary Drains: Provide auxiliary drains at all low points of the system, where the trapped section of pipe exceeds five gallons. The drain shall consist of, as a minimum: a valve, a 3/4" brass nipple with 3/4" male hose threads, and cap. Locate auxiliary drains in unfinished areas without suspended ceiling wherever possible. In finished areas, with lathe and plaster or GWB locate the hose bib within six inches of an access panel, minimum 12" x 12". If located in bathrooms the panel is to be stainless steel.

3.06 GAUGES: Provide gauges at the main system riser and each floor control valve. Tap gauges from the main piping, not from the drain piping.

3.07 LAY-IN CEILINGS: *Designer, modify as required, this shall be the minimum. For lay-in suspended acoustic ceilings, sprinklers shall be located between the one-quarter and three-quarter points of the tiles in both directions and shall be carefully aligned.*

3.08 EARTHQUAKE BRACING: Install earthquake bracing in accordance with NFPA 13 and as clarified in the Handbook of Automatic Sprinkler Systems. Provide earthquake bracing as follows, but is not limited to these locations:

A. Lateral Bracing: Provide lateral bracing at least every 40 feet, regardless of length of hanger.

B. Longitudinal Bracing: Provide longitudinal bracing at least every 80 feet for long straight runs of main.

C. Flexible Couplings: Brace all flexible couplings, except for risers where flexibility is required. Provide four-way bracing for all tees, elbows, and offsets.

3.09 INSPECTION, TESTING AND PUNCH LIST:

A. Partial System Test or Inspection: Perform tests with the sprinklers installed in their final positions. Where it is critical to the continuance of the project as a whole to cover portions of the piping with ceilings or walls prior to the completion of the entire system, partial testing of the system may be performed after receiving written approval from the Owner. In this case "partial" indicates an entire zone or floor of one system. A satisfactory partial test does not relieve Contractor from performing all final testing procedures.

B. Required Inspections/Tests: The contractor shall satisfactorily complete the inspection and tests listed below before final approval of the system will be granted. The contractor is responsible for providing all equipment and labor necessary to perform all inspections and tests. Submit request for inspection/testing to the General Contractor at least 15 days prior to the test date.

1. Flushing of underground piping
2. Hydrostatic testing of underground and aboveground piping
3. Inspection of piping before installation of wall/ceiling material
4. Final piping inspection
5. Functional test

c. Flushing and hydrostatic inspections and tests shall be witnessed by City Engineers, Project Manager and the General Contractor. All other inspections and tests shall be witnessed by the City Engineers, Project Manager, and General Contractor.

D. Flushing of underground piping: Underground piping and lead in connections to system risers shall be flushed thoroughly before connection is made to sprinkler piping, in order to remove foreign materials which may have entered the underground during the course of the installation or which may be been present in existing piping.

1. Testing procedures: Underground piping shall be flushed in accordance with the latest edition of NFPA 24. The minimum rate of flow shall not be less than the water demand rate of the system which is determined by the system design, or not less than that necessary to provide a velocity of 10 fee per second (3 m/s), whichever is greater. For all systems, the flushing operations shall be continued for a sufficient time to ensure thorough cleaning. Provisions shall be made for the disposal of water issuing from test outlets to avoid property damage.

a) Exception: When the flow rate cannot be verified or met, underground piping shall be flushed at the maximum flow rate available to the system under fire conditions.

2. Flushing shall be considered satisfactorily completed when no debris emanates from the piping or the piping has been flushed for a time period acceptable to the City and General Contractor representatives.

E. Hydrostatic testing of underground piping: A hydrostatic test shall be performed on the underground piping, including the fire department connection, in accordance with NFPA 13

and 24. Piping between the check valve in the fire department inlet pipe and the outside connection shall be tested in the same manner as the balance of the system.

1. Test procedures: Test the complete system for not less than 2 hours at a pressure of 200 PSI (or 50 psi above static pressure, whichever is greater) without the addition of any water. Piping shall be covered in such a manner as to keep the joints and thrust blocks visible. Take special precautions to detect and stop water leakage so that any water damage will be minimal.

    a. Exception: Piping may be covered so long as all joints and thrust blocks are visible.

2. Whenever a test blank is used, it shall be of the self-indicating type. Test blanks shall have red painted lugs protruding beyond the flange in such a way as to clearly indicate their presence. The installer shall have all test blanks numbered so as to keep track of their use and assure their removal after the work is completed.

3. Refer to MFPA 24 for permissible leakage in underground piping. The amount of leakage shall be measured by pumping from a calibrated container. Any leaks or drips shall be repaired immediately by the Contractor. Additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals shall not be used for testing systems or stopping leaks.

F. Hydrostatic testing of aboveground piping: A hydrostatic test shall be performed on all aboveground piping in accordance with NFPA 13.

1. Test procedures: The test procedures for preliminary and final testing shall be identical. Test the complete system for not less than two hours at a pressure of 200 psi (or 50 psi above static pressure, whichever is great) without the addition of any water. The test pressure shall be read from a gauge located at the low elevation point of the individual system or portion of the system being tested.

    Whenever a test blank is used, it shall be of the self-indicating type. Test blanks shall have red painted lugs protruding beyond the flange in such a way as to clearly indicate their presence. The installer shall have all test blanks numbered so as to keep track of their use and assure their removal after the work is completed.

2. Aboveground piping shall be installed in such a manner that there will be no visible leakage or drop in gauge pressure when the system is subjected to the hydrostatic pressure test. Any leaks or drips shall be repaired immediately by Contractor. Additives and corrosive chemicals, sodium silicate or derivatives of sodium silicate, brine, or other corrosive chemicals shall not be used for testing systems or stopped leaks.

G. Inspection of piping before installation of wall/ceiling material: All piping and related material shall be inspected for proper installation before wall and/or ceiling material is installed.

1. Inspection procedures: Inspection of piping shall consist of verification of correct pipe size, length and fittings in conformance with the Contractor's approved shop

drawings. Pipe, hangers, and sway bracing shall be inspected for proper installation methods.

2. Piping, hangers and sway bracing shall be considered satisfactorily installed when the installation is in conformance with the Contractor's approved shop drawings and NFPA 13. Deviations from the approved shop drawings shall be approved by the City Engineer and the Project Manager. When, in the opinion of the City Engineer or Project Manager the installation deviates greatly from the approved shop drawings, revised shop drawings and hydraulic calculations may be required to verify the installation.

H. Final piping inspection: : After installation of all wall/ceiling material and all sprinkler heads, the sprinkler system shall be inspected for proper sprinkler coverage, valve location and signage.

1. Inspection procedures: Inspection of the system shall consist of verification of proper sprinkler head coverage throughout the entire building. Valve locations shall be verified to ensure proper height and clearance. Signage of all concealed valves shall be verified.

2. Final sprinkler head placement shall be considered satisfactorily complete when all sprinkler heads are installed in accordance with their listing or approval and the Contractor's approved shop drawings. The Contractor may be required to relocate or add additional sprinkler heads if proper sprinkler coverage is not provided due to unforeseen or modified architectural conditions.

I. Functional test: All valves, switches and test connections shall be operated to ensure conformance with the Contractor's approved shop drawings and the manufacturer's specifications.

1. Test procedures: Operate all control valves to verify proper operation of the valve and associated tamper switch. Operate all test connections to verify waterflow switch operation.

a. Dry pipe valves: The clapper of a differential type dry-pipe valve shall be held off its seat during any testing excess of 50 psi to prevent damage to the valve.

b. Dry-pipe system air test: All dry system piping shall be pressurized to 40 psi of air pressure for 24 hours in order to verify leak tight installation.

c. Dry pipe valve operation: Operate the dry system inspector's test connection. The following information shall be recorded on the Contractor's Material And Test Certificate during the valve operational test: time for valve to operate, time to receive water at inspector's test connection, static supply water pressure, system air pressure and air pressure at valve release.

2. The final functional test shall be considered satisfactorily complete when all valves and switches perform in accordance with the contractor's approved shop drawings and the test procedures above.

a. Dry pipe system air test: The piping system shall not allow a loss of pressure over 1 psi in 24 hours. All leaks resulting in a loss over 1 psi shall be repaired and the system retested.

b. Dry pipe valve operation: Water shall be received at the inspector's test connection within 60 seconds of operation of the test connection.

c. The high/low supervisory switch shall activate when system air pressures are 10 psi above the air maintenance shutoff pressure or 10 psi below the air maintenance starting pressure. The air maintenance device shall be set to start and stop in accordance with NFPA 13 and the manufacturer's recommendations.

d. Floor or zone waterflow switches shall be received at the Fire Alarm Control Panel within 20-35 seconds after operation of the inspector's test connection. The maser waterflow switch shall be received at the Fire Alarm Control Panel within 40-60 seconds after operation of the inspector's test connection.

e. Valve tamper switches shall activate within the first two complete revolutions of the valve handwheel.

J. Punch List: Should the results of the inspection/test not be satisfactory to the City representatives, deficiencies will be recorded on a punch list and delivered to the Contractor. Corrections will be made within two weeks of receipt of the punch list, no exceptions, at the Contractor's expense and a reinspection/test will be made.

K. Certificate of Completion: A completed contractor's test and materials certificate shall be delivered to the Owner upon satisfactory completion of the work.

End of Appendix 3 - B